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mately synchronal. We find that the method of inhumation practiced by this local clan or branch of the tribe did not differ materially from that of other divisions situated in other portions of the State. The bodies were generally extended at full length from east to west, sometimes encased in rude stone cists, but more frequently laid to rest with no covering except the vestments which had been worn in life. Occasionally, as we have seen, under the influence of civilization, the departed were encased in wooden coffins, furnished the tribe undoubtedly by their European neighbors.

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NOTES ON SOME FISHES OF THE COAST OF CALIFORNIA. No. I.

BY W. N. LOCKINGTON.

THE accompanying notes are chiefly the result of periodical visits paid to the markets of San Francisco during the months of October, November and December, with the object of ascertaining the comparative abundance of the various species, the localities where they are taken, their value as articles of food, etc., etc.

No attempt at classification is made, and in the generic names I have in most cases followed Günther, with whose works I am better acquainted than with those of Gill. *Sarda* is substituted for *Pelamys*, which is also the title of a genus of Hydrophoid snakes, and Prof. Jordan informs me that the snakes have a prior right to it.

The ichthyology of the Pacific coast of North America is as yet far from being fully worked out; in many cases there is considerable confusion of names, and little is known respecting the food, habits, spawning season, &c., of most of the species.

Several rare and some probably new fishes have been brought to the markets this year, principally because the fishermen use trawl-nets to a greater extent, and trawl to a greater depth than they were previously accustomed to do.

Ambloplites interruptus Grd. Sacramento River Perch.—This species is abundant along the lower course of the Sacramento and San Joaquin rivers, and in all the branches of those rivers that permeate the lowlands; and forms an important article of

food not only to the white inhabitants of the district, but also to the Chinese, who are particularly fond of it, catch it in immense numbers and forward it to their countrymen along the railroad as far as the boundary of the State, or even beyond it. It is usually taken in fyke-nets, which are most effective engines of destruction. It is occasionally brought to the markets of San Francisco, but has not been at all common there during the months of October, November and December. It is a very good fish for the table, unless taken in sloughs that by the falling of the water have become disconnected with the river.

Anoplopoma fimbria (Pallas) Ayres, Candle-fish.—This species is very rare in the markets of San Francisco, but appears to have been more abundant this year than at any previous period.

Dr. W. O. Ayres (Proc. Cal. Acad., 1859) states that in his time stragglers only occurred in the markets; and the fish-mongers call it a "new" fish, and declare they have never seen it before. Dr. Ayres gives the number of rays in the first dorsal as twenty-three, but I can only find twenty-one in the specimens I have examined. Probably the number varies slightly. The outline figure in the Proc. Cal. Ac. Vol. I, 1859, shows twenty-two. The tail is much more deeply emarginate than is shown in the figure, as the central rays are only about half as long as the outer ones. Most of the individuals brought to the markets this year were not over ten inches in length, but Dr. Ayres states that he saw one that measured eighteen inches. The fishermen call this species candle-fish, but whether on account of its oiliness, of its length and slenderness, or of a fancied resemblance to the species called candle-fish in Oregon and northward I cannot tell. The last-named candle-fish (*Ammodytes personatus* Grd.) is not at all nearly related to the present species, but belongs to the *Ophidiidae*, a tribe approaching the eels in many particulars; it is so oily that it is said that the Indians make their candles by pulling their yarn through its flesh. Since October *A. fimbria* has not occurred in the markets, but it is not unlikely that the severe weather which prevents the fishermen from trawling is the cause of this.

Ophiodon elongatus Gir., Green Rock Cod.—This is one of the largest and commonest of our marketable fishes, frequently attaining a length of over three feet; and is usually in great part of a lively green color, spotted or clouded with light brown. But the coloration of the adults varies greatly, the brown markings sometimes

cover almost the entire fish, and different shades of brown occur in the same individual. The young is spotted with round spots of a light yellowish-brown, and it was to the young that the name *Ophiodon elongatus* was originally given by Girard, who described the adult with the title of *Oplopoma pantherinum*. *O. elongatus* was said to have a continuous dorsal with twenty-seven spines, and no membranous flap upon the forehead; while *Opl. pantherinum* was characterized by two separate dorsals, the first with twenty-five spines, and by the presence of a membranous flap,

Dr. Steindachner corrects this error (*Ichthyologische Beiträge*, No. III), and proves that the continuous dorsal and membranous flap are characters of the species.

The correct number of spines is twenty-seven, but the adult frequently comes to market in a dilapidated condition, with the spines torn apart from each other, or even broken away, and it is most probable that Girard described his *O. pantherinum* from such a mutilated specimen. Young and half grown individuals are common in the bay of San Francisco, but the larger examples are taken in tolerably deep water outside the bay, especially in the vicinity of the Farallones. A large individual that I measured as it lay upon the stall was three feet two inches long. Steindachner gives the range of this species as from Sitka to Monterey.

Chirus constellatus Grd., and *C. guttatus* Grd.—These species have been brought to market regularly, though not in great numbers, throughout the three months under review, and indeed appear to be always in season. Those brought to market are usually taken in the bay.

Scorpaenichthys marmoratus Grd., the large red sculpin.—Despite the absence of scales upon its body, this species is commonly styled a rock cod. While its nearest relations, the smaller sculpins, or catfish, as they are often called here, are thrown away by the fishermen, this large sculpin is allowed a place among our food fishes. *A priori* one would expect the other sculpins to be good food, and I am assured by those who have tried them that they are; all they need is skinning before cooking.

Sebastes fasciatus Girard, clouded rock cod.—The name *fasciatus* is much less appropriate than Ayres's name of *nebulosus* (over which it appears to have the right of priority), since the broad light-yellow band which suggested the name is usually

absent, and the dark and light tints of the sides of the body are mingled together without any regularity. This is one of the smallest of the genus, but has been known to reach the weight of seven pounds.

Sebastes nigrocinctus Ayres, black-banded rock cod.—This is one of the rarest of our edible fishes, as only single individuals are brought to the market at considerable intervals of time. Only two specimens have hitherto come under my notice, and one of these has the black transverse bands much more developed than the other. It is not taken inside the bay.

Sebastes rosaceus Girard, smooth red rock cod.—This species appears to attain a larger size than any of its congeners except *S. ruber*, which it equals in length but not in weight, as it is more slender and seldom or never exceeds fourteen pounds in weight. *S. rosaceus* is taken outside the heads.

Sebastes melanops Girard, black rock cod.—This fish does not usually attain so large a size as *S. ruber* or *S. rosaceus*, at least in the locality where it is usually taken, viz: within the bay of San Francisco. It is one of the commonest kinds of rock-fish.

Sebastes ruber Ayres, rough red rock cod.—This, the largest of the genus occurring in our waters, is stated to reach, though rarely, a weight of twenty-five pounds. It is of a uniform bright red, very different from the brownish-red mingled with orange-red, which forms the livery of *S. rosaceus*. In form it is stouter than *S. rosaceus* but less so than *S. fasciatus*. It is taken outside the bay, usually from deep water around the Farallone islands. It occurs also northward at least as far as Humboldt bay.

Sebastes auriculatus Gir., black-shouldered rock cod.—This is rather a small species, seldom exceeding eighteen inches in length, and is brought to the markets in great abundance, probably on account of its common occurrence in the bay. Not only does this species occur, together with two or three others of the smaller kinds of *Sebastes* and the young of the larger kinds, in the deeper portions of the bay near the entrance, but it is also abundant along the eastern shore of the bay, where no other species of the genus is found, probably on account of the admixture of fresh water from the Sacramento river.

Sebastes helvomaculatus Ayres, pink-spotted rock cod.—This is smaller even than *S. fasciatus*, not equaling it in length and of much more slender form. The three elongated pink spots along

each side are constant, and at once distinguish it from every other species. In color it resembles *S. ruber*. Though not so common as *S. auriculatus*, or *S. melanops*, or even as *S. nebulosus*, *S. ruber* or *S. rosaceus*, it is occasionally brought in, in considerable numbers.

For all the above species of *Sebastes*, as well as for *S. flavidus* Ayres, *S. paucispinis* Grd., and *S. elongatus* Ayres, the fishermen have no other English names but rock cod or rock fish, although they can readily distinguish between the species. I have, therefore, coined names for them from their most obvious characteristics. All the species named, except *S. elongatus*, have occurred in the markets during the months of October, November and December. The names rock cod and rock fish are also applied to the various species of *Chirus*, to *Ophiodon elongatus* and even to the scaleless *Scorpenichthys marmoratus*.

Sphyræna argentea Grd., the barracuda.—It is well not to be misled by English names; that of *Barracuda* is applied not only to all the species of *Sphyræna*, of which there are several, but also to fishes of other families, and even other orders. In the rivers of South America the name is given to the *Sudis* (*Arapaima*) *gigas*, a soft-finned, large-scaled, fresh-water, carnivorous fish. All barracudas, however, are fierce, rapacious fishes, and the one we are at present considering attains a length of over three feet, and a weight of from twelve to fourteen pounds. The form is slender but it is nearly as thick as it is deep, and its jaws are armed with a formidable row of sharp teeth. When darting through the water it looks like a silver arrow. It is usually obtained south of the bay and at the Farallones, but occurs at least as far north as Tomales. Its flesh is very good eating, so that if it devours our food fishes, we may console ourselves by devouring it.

Genyanemus lineatus Gill, *Sciæna lineata* Günthr., the king-fish.—This species was formerly common in the bay, but since its waters have been defiled with so much tar and drain refuse by our destructive and imperfect civilization, it has become scarce, and is now usually obtained outside. It is, in my opinion, one of the most delicate of our food fishes.

Sarda lineolata Girard.—This, like all the Pacific coast Scombridæ, is not very often brought to the markets of San Francisco, and is, therefore, a high-priced fish. Those that come here are caught in Monterey bay.

Günther (Cat. Fish. Brit. Mus., 11, 368) considers this species to be identical with the *Pelamys chilensis* of Cuv. and Val. It attains a considerable size, a series of four specimens lying on the stalls in November of this year measuring respectively two feet two and a quarter inches, two feet two and three-quarter inches and two feet three and a half inches, from tip of snout to fork of caudal fin. The caudal fin cannot be said to be crescentic, as stated by Girard, since its posterior margin forms two sides of an obtuse isosceles triangle. The sides and belly are silvery, becoming bluish-black towards and on the back, and five or six obliquely longitudinal bands of the darker tint run along the sides.

Scomber colias, Spanish mackerel.—The *Scomber diego* described by Ayres (Proc. Cal. Ac., 1, 1857, 92) has been proved by Steindachner to be identical with the long-known *S. colias* or Spanish mackerel of the European seas. Steindachner states that it occurs frequently on the coasts of the Galapagos islands, and wanders in small shoals along the Californian coast as far as San Diego, also that single individuals occur near San Francisco. I have never seen this fish in the markets, but the fishmongers appear to be acquainted with it. Thus this species and *Albula vulpes* are among the few fishes which inhabit both the Atlantic and the Pacific oceans.

Stromateus simillimus Ayres, pompano.—This species was first described by Dr. Ayres (Proc. Cal. Acad., Vol. 11, p. 84, fig. on p. 85) in December, 1860, and accompanied by a good outline figure. Dr. Ayres states that in the course of seven years he only saw three or four specimens; but this year, at least, it is far more abundant, as I have seen as many as thirty or forty on the same stall on two or three occasions during October. As with the other Scomberoids, the examples brought to this market are caught in Monterey bay, which appears to form the northern limit of many species of fishes, crustacea and echinoderms.

As in the arrangement of the fishes in the Museum of the California Academy of Science, we are, at present, following the classification of Dr. A. Günther, of the British Museum, the name of this species must be changed from *Poronotus simillimus*, the title given it by Dr. Ayres, to *Stromateus simillimus*; as Dr. Günther admits no such genus as *Poronotus*, and it agrees with *Stromateus* in the entire absence of the ventral fins, short elevated form of body, and single long dorsal and anal fins.

The Italian fishermen call this species "pompino," and this must be accepted, in the absence of any other, as its English name. I am informed that a fish called "pompino," on the Atlantic coast, is considered to be the most delicate of all fishes; this is *Trachynotus carolinus*, a very different species. Our "pompino" is also highly prized as a delicate morsel, and is one of the dearest fishes in the market.

Mr. B. B. Redding has given me an account of a little practical joke in which the New Orleans species of pompino is concerned. When, during the civil war, Dr. Russell was in this country as correspondent, I believe, of the *Times*, he was so anxious to taste the celebrated pompino that he obtained leave to pass through the lines and visit New Orleans for the purpose. It happened, however, that pompino was not in season, but a perch of somewhat similar size and form, aided by the cookery of a clever negro cook, was passed off upon him as pompino. Dr. Russell ate, relished exceedingly, and wrote to his paper a glowing description of the gustatory delights of pompino, and it was not till some years after that it transpired that pompino was not then in season, and that he had been put off with perch.

Mugil mexicanus (?) Steind.—Several specimens of a species of Mugil, evidently very close to the above species, if not identical with it, have found their way to our markets in the months of September and October. All of them were taken near Santa Cruz, in the bay of Monterey.

The specimens examined agree with *M. mexicanus* in the number of scales in the lateral line, and of rays in the vertical fins, in the length of the latter, in the produced upper caudal lobe, and in the proportions of the body and head, and I should not hesitate to pronounce them to be of that species were it not that Mr. B. B. Redding, one of the Fish Commissioners for the State of California, has informed me that about three years ago he placed several (I believe about forty) individuals of a Mugil from the Sandwich islands in the Sacramento river, and it is, therefore, possible that the specimens obtained may be some of these, or their young. I suspect this because the shad introduced from the East, finds its way in considerable numbers to Monterey bay, instead of dutifully returning to the place of its birth, and this Mugil may have acted in a similar way; also because the specimens agree tolerably well with the diagnosis of *Mugil cephalotus*,

given by Günther. The inter-mandibular space agrees pretty well with Günther's figure of that of *M. cephalotus*, but it is still nearer to Steindachner's figure of *M. mexicanus*. As this is a mullet, it is of course tolerably good eating, but it must be remembered that it is not nearly related to those famous delicate fishes, the red mullet and the surmullet, which were so highly prized by the Romans that they fed them in aquaria, but to the gray mullet. The first-mentioned fishes belong to the *Mullidæ*, and are provided with a barbel, the latter and our Californian fish to the *Mugilidæ*, which has no barbel and no teeth worth speaking of.

Brosmophycis marginatus Ayres.—This is a very rare species, so much so that although it is taken in the bay of San Francisco, I have as yet seen only a single specimen, and Mr. Johnson, of the California market, whose practical knowledge of fishes can be safely relied upon, informs me that in the three years that have elapsed since he first noticed it, he has only seen three individuals. *Marginatus* is a very good name for the fish, as the long fin which encircles the greater half of the body, undivided into dorsal, anal and caudal fins, is of a vivid red in the fresh fish, and forms a most conspicuous margin. The exudation of mucus from the surface of the skin is most abundant, rapidly forming an epidermal covering, and it is therefore no wonder that my friend Mr. Johnson characterized it as a kind of eel. In thus naming it he was not so very far off after all, since the family *Ophidiidæ*, to which it has been referred by Dr. Günther, is in many respects intermediate between the *Gadidæ*, or cod tribe, in which it was originally placed by Dr. Ayres (under the name of *Brosmus marginatus*), and the *Muraenidæ*, or eel tribe. As it has hitherto had no English name, I venture to call it the red-fin, on account of its most obvious peculiarity. The family *Ophidiidæ* contains some species of parasitic habits, vertebrates parasitic upon invertebrates, a strange inversion of our ordinary experience.

Smelts.—Several species of fish are commonly sold in this city under the collective name of "smelt." The species usually met with are *Atherinopsis californiensis* (Girard), *A. affinis* (Ayres), *Hy-pomesus olidus* (Pallas) Gill, and *O. smerus thaleichthys* (Ayres).

The two last of these are Salmonoids, and therefore have a right to the name of smelt, but the two former belong to a very

different family, the *Atherinidæ*, and are said to be much less delicate in flavor than the others. A third *Atherinopsis*, *A. tenuis*, was described by Dr. Ayres (Proc. Cal. Ac. Sci., 11, 75, fig. on p. 76) but it is very rare, and I have not yet seen it.

These fishes may be readily distinguished as follows: The two kinds of *Atherinopsis* have two dorsal fins, the first very small, placed about in the center of the length of the back, and formed of *spines* or stiff rays, the second rather larger, and separated by an interval from the first. Their prevailing color is light green.

The two Salmonoids have a dorsal fin, formed of *soft* rays, in or near the center of the dorsal outline, and a fleshy fold, or "adipose fin," placed farther back near the tail.

Atherinopsis californiensis is a larger fish than its congener, reaching a length of seventeen inches, and it may be distinguished by its larger head, more slender form of body, larger mouth and the central position of the first dorsal.

In *A. affinis* the dorsal is nearly its own length further back, the form of the body is much stouter, the head proportionally smaller, the mouth smaller, the fins larger and the flesh firmer. Dr. Ayres states that this species never exceeds eight inches in length, and this size must be but rarely attained, as the specimens I have seen in our markets seldom pass six inches, while *A. californiensis* usually exceeds twice that length.

Osmerus thaleichthys is really the nearest representative of the smelt of Europe, having the peculiar, pleasant smell that suggested the name in that species, which is also a kind of *Osmerus*.

It may readily be distinguished from the two previous species by the want of spinous rays on the back, by the adipose fin, by the absence of the bright green tint which is replaced on the back by a dull greenish-olive, on which a diamond pattern is traced by rows of minute dark dots that fringe each scale, and by its smaller size. From the other small Salmonoid it may easily be known by the comparatively large size of the mouth and less transparent appearance. It is usually from five to five and a half inches in length. Its form is stouter than that of *Hypomesus olidus*, the flesh is soft in texture, and the pectoral fins reach very nearly to the origin of the ventrals.

Hypomesus olidus (Pallas) Gill, is called "whitebait" by those who are familiar with the delicate fish known by that name in England, yet is not very nearly related to the real whitebait, which is asserted by Dr. Günther to be the young of the common

herring of the Atlantic. Its dimensions are about the same as those of the preceding species, but the mouth is very small, the end of the maxillary bone reaching only level with the front of the eye, while in *O. thaleichthys* it reaches to the back of the orbit. The head also is somewhat smaller. But this fish, when fresh, can be most readily distinguished by the transparency of its flesh, which, of course, disappears entirely in preserved specimens. The silvery band along the sides, which is found in all the four species, and is probably the cause of their being grouped together as smelts, is particularly bright in this fish.

I have not yet been able to ascertain at what season each of these species may be most common, but all are abundant in the markets throughout October, November and December.

Albula vulpes (*Albula conorhynchus* Günthr., Cat. Fish. Brit. Mus., VII, 468).—This widely distributed species has been found at various points along the Pacific coast of North America. Günther (Cat. Fish. Brit. Mus. VII, 469) mentions its occurrence on the coast of Central America; Steindachner (Sitz. Ak. Wiss. Wien., 1875, 61) incidentally states (in his description of *Mugil brasiliensis*) that it is found at San Diego; in the same year I received two specimens from Lower California, probably from Magdalena bay, as the fishes accompanying it came from that place; and lastly, in September, 1878, several specimens were brought to the markets of San Francisco. The fishmongers could not tell the exact locality from which these individuals were brought; but as few, if any, marine fishes find their way to our markets from points south of Monterey bay, and as that bay is frequented by many other fishes which are not found, except as stragglers, to the northward of it, I think it probable they came from thence.

The specimens from Magdalena bay (Lockt. Proc. Cal. Ac., 1876, 83) were most beautiful in their coloration, glowing with burnished silver below, deepening to gold upon the sides, and to darker metallic tints on the back; but those found in the markets this year were uniform silvery, as described by Günther.

By a typographical error in my Notes on Californian Marine Fishes (loc. cit., p. 84), the length of the example from Lower California is given as 3".7 instead of 1'-3".7. Those brought to market this year were only partly grown. The question arises whether the metallic colors are confined to the adults, or are the result of peculiarities in the environment.